APPARENT MOTION AS A FUNCTION OF INSTRUCTION, FORM AND RATE OF STIMULATION

By

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CHAPTER 1

INTRODUCTION AND STATEMENT OF PROBLEM

Introduction

The study is concerned with the variables of instruction, figural relationships, rate of stimulation, and their interactions as major determinants of apparent motion.

Numerous reviews of the literature on apparent motion (1, 4, 9, 14) note that instruction is an important variable in the perception of apparent motion. Related variables, such as attitude, mental set, and suggestion, are also reported as factors to be considered in experimental investigations of apparent motion. The major differences among these variables appear to be the point of origin. That is, instructional changes and/or suggestion generally originate with the experimenter; attitude and mental sets are generally considered to be observer oriented.

Systematic attempts to study these factors in apparent motion have seldom been attempted. The major investigator of the effect of instruction on apparent motion was Neuhaus (10). He reported that apparent motion may be obtained through direct instructions or suggestions. Trained observers, for example, perceived apparent motion under conditions in which naive observers were not able to do so. Neuhaus (10) reported that suggestion and experience of the observer are major factors in the perception of apparent motion. Kelly (6) sion found that trained observers differed significantly from naive observers. Crisosky (11) disagreed with Neuhaus in that he found suggestion to the observer ineffective as a determinant of apparent motion.

Other investigators (2, 3) reported on the effectiveness of oriented variables such as attention, tendency, and or mental sets as determinants of apparent motion. DeSilva (2) noted that a passive attitude facilitated the perception of motion, while an actively discriminating attitude inhibited the perception of motion. Gilbert (3), in his studies on apparent motion, found that mental sets were important determinants in the perception of apparent motion. One of his observers reported voluntary control over reversals making it possible to see "four beats phi, four beats flicker, and so on--or any rate of reversal." (3, p. 20) In a previous study the author (12) noted that many of his subjects reported the belief that they had voluntary control, i.e., facilitate or inhibit, their perceptions of apparent motion. A systematic attempt to evaluate both the effect of formal changes in instruction, i.e., direct changes originating with the experimenter, and formal changes, i.e., observer-oriented attitudes and/or mental sets, will be tried in this study. Instruction will be treated as a fixed variable.

A second fixed variable, figural relationship, is included in this study. Neff (9) cited the work of Linke and others who reported that apparent motion is affected by such factors as similarity of form, stimulus configuration, conventionality of figures and the familiarity of figures. Recent investigators (8, 11, 12) have reported on the effect of form upon apparent motion. Orlansky (11) reported, in a series of studies with form as a variable, that he found the greatest range of apparent motion with combinations of similar figures. The range was measured as the difference between two thresholds during which apparent motion was reported by the observer. "There are two thresholds, one between phenomenal succession and apparent movement and another between apparent movement and phenomenal simultaneity." (11) Orlansky reported that differences in forms were shown to be more effective in restricting the range of motion than were differences in the position of the figures (11). Reichenberg (12) reported the effectiveness of form as a determinant in apparent motion, but contrary to the findings of Orlansky, he found the smallest mean time reported with identical figures. That is, the perception of apparent motion was maintained for significantly longer periods with dissimilar figures. The latter findings would appear to be contradictory to those of Orlansky if duration of motion and range of stimulus rate are considered as similar measurements. Murphree (8) related the perception of form as an effective variable in apparent motion to serve sets, of which the alpha rhythm is an integral part. Form, in terms of figural relationships, is included in this study as a result of many contradictory statements to be found in the literature.

The third fixed variable, rate of stimulation, is included although there appears to be sufficient evidence (12, 13, 17) that it is a primary determinant of apparent motion. It is included to investigate its possible interactions with the other variables.

Statement of Problem

A factorial investigation in which instruction, figural relationships, and rate of stimulation were the fixed variables, and subjects, as a randomized variable, was planned. These variables, and their interactions, are to be statistically treated with an analysis of variance technique. Selected analyses will be treated with a non-parametric test for significant differences. Four instructional sets, two involving changes in formal instructions to the observer and two involving observer attitudes or mental sets, are included In addition there are three rates of stimulation and two pairs of stimulus figures The following hypotheses are evaluated

a. that formal instructions may significantly effect the duration of apparent motion.

b. that attitude or mental set may not significantly effect the duration of apparent motion

c that the figural relationships, rather than the specific forms, may significantly effect the duration of apparent motion

d, that the rate of stimulation will be the primary determinant of apparent motion regardless of the instructional set or the stimulus figure involved.

CHAPTER II

APPARATUS AND PROCEDURE

Apparatus

The apparatus consisted of (1) an electronic switch, (2) a stimulus light panel, (3) a subject's headrest and (4) a constant speed recorder operated with a telegraphic key in addition to a tape voice recorder.

The electronic switch, described by Saucer (13), controlled the flash rate, light intensity, duration of light and dark periods, and the rate of alternation for two Sylvania 1130B electronic tubes. The electronic switch and the recording apparatus were installed in the experimenter's booth as shown in Fig. 1.

The stimulus light panel, containing the 1130B Sylvania flash tubes, was placed in the subject's enclosure as shown in Fig. 1. The entire experimental area was painted a flat black. The light source before placement of the stimulus figures averaged 6 millilamberts per light, as measured with a Macbeth illuminometer. The light panel was 1 meter from the subject's headrest

The subject's headrest was placed in a frontal plane in relation to the stimulus light panel. The visual angle for all subjects was approximately 5 degrees. The telegraphic key and microphone pick-up were placed as indicated in Fig. 1.

Three independent records of each experimental trial were obtained with the recording apparatus. The subject operated the telegraphic key which was connected to the Gerbrands constant speed recorder. An Eicor tape recorder, with the microphone pick-up at the subject's headrest, recorded his verbatim reports. The third record was obtained by the experimenter who wrote a verbatim report and timed the subject's perceptions with the aid of a stop watch. The three records were cross checked for the duration and verbatim description of the subject's perception for all experimental trials.

The Stimulus Figures

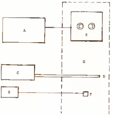
The stimulus figures were geometric in form and engraved on clear plastic with an opaque black plastic backing, so that only the engraved forms allowed light to pass. These discs were mounted in the stimulus light panel, as described by Reichenberg (12), and presented in pairs to the subjects. The basic figures were open-sided squares and triangles, half circles and a pair of full circles. The combinations (Fig. 2), were arranged to provide the following figural relationships:

a. *Similarity*, in which the two figures were identically situated.

b. *Closure*, in which the two figures faced each other.

c. *Proximity*, in which the two figures were placed back to back.

d. *Complete Circles*, in which a pair of full circles was presented



Legend

A. Electronic switch
B. Light panel
C. Gerbrand recorder
D. Key operated by observer
E. Eicor tape recorder
F. Microphone
G. Observation booth

Fig. 1. Block diagram of apparatus.

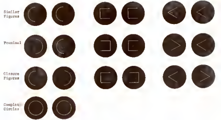


Fig. 2. Stimulus figure patterns.

Procedure

Before the experimental trials were run, each observer was dark adapted for ten minutes (5), and then presented with a pair of vertical lines in the stimulus field for 5 minutes. During this pretrial observation period each observer was instructed in the use of the telegraphic key and the microphone hook-up for his reports.

Once the subject began the experimental trials he reported his observations in five minute periods for all pairs of stimulus figures. The ten pairs of figures were observed for all rates of stimulation and under all four sets of instructions. All subjects began their observations under Instruction I. Instructions II, III, and IV were presented in a systematically balanced order. The rates of stimulation and the stimulus figures were systematically balanced for all sets of instructions. The following verbatim instructions were presented to the subjects:

Instruction I. You are to report orally, and with the telegraphic key, anything but two stationary lights blinking on and off.

Instruction II. You are to report orally, and with the telegraphic key, only those perceptions of motion in which one light, or one figure, is involved.

Instruction III. You are to report orally, and with the telegraphic key, anything but two stationary lights blinking on and off. When motion is perceived you are to try to maintain your perception of motion as long as possible. You are not to turn your head, blink your eyes rapidly or voluntarily alter your physical viewing in any way.

Instruction IV. You are to report orally, and with the telegraphic key, anything but two stationary lights blinking on and off. You are to try to prevent the appearance of apparent motion as much as possible. However, you are not to turn your head, blink your eyes rapidly or voluntarily alter your physical viewing in any way.

The two pairs of stimulus figures were presented to the observer for each of three rates of stimulation. Rate 1 represented a flash rate of 1.25 flashes per light per second. Rate 2 represented 2 flashes per light per second. Rate 3 represented 3 flashes per light per second. The interval between flashes, i.e., pause time, was approximately 5 microseconds. The light was white.

Each subject was given instruction 1. He was dark adapted for ten minutes prior to the experimental trials. He was exposed to five minute observation periods for each of the ten pairs of stimulus figures under a given rate of stimulation. The subject was asked to report orally and to press down the telegraphic key during all perceived motion. The key was to be released if apparent motion was interrupted, i.e., if two stationary lights blinking on and off were observed. At the end of the tenth pair of stimulus figures each subject was permitted to leave the dark room for approximately ten minutes. When he returned he was again dark adapted for ten minutes before starting another series of experimental trials. He then reported on the same ten pairs of stimulus figures, in five minute observation periods, for another rate of stimulation under instruction 1. This procedure was repeated a third time after a ten minute rest period. No subject observed under more than one set of instructions on a given day.

In summary, each subject reported, in five minute observation periods, for each of ten pairs of figures, for each of three rates of stimulation under four separate sets of instructions. Twelve separate sequences of presentation of the fixed variables were systematically ordered and randomly assigned to the twelve observers. They were adult, male subjects trained in psychological experimentation. Dark adaptation periods of ten minutes each preceded all observations for each change of rate.

CHAPTER III

RESULTS

Two quantitative measures were analyzed individually with a four dimensional analysis of variance: instruction x form x rate x subjects. The design was expanded from the basic design found in Lindquist (*7*, p. 237).

The first of the measures of apparent motion was total duration. This represented the total period of reported apparent motion for each 300 seconds of observation. The second quantitative measure obtained was the mean duration of motion. The mean duration represented the total duration of apparent motion divided by the number of separate and distinct perceptions of motion reported by the observer for each 300 seconds of observation. Three independently obtained quantitative records were obtained from the Gerbrand's constant speed tape, the timed voice tape, and the timed experimenter's record. These records were cross-checked, for both total and mean duration of apparent motion, to insure accuracy.

Both of the measures were computed for various aspects of apparent motion and separate analyses were obtained for the following categorical descriptions of apparent motion:

a. all apparent motion perception, i.e., both lighted figure motion and shadow motion.

b. perception of lighted figures in motion, i.e., one lighted figure perceived in motion as well as apparent motion involving two lighted figures.

c. all shadow motion, i.e., perceived motion of a black shadow area rather than the lighted areas.

d. all apparent motion involving only one lighted figure, i.e., fusion of the two figures into one figure.

e. all apparent motion involving lighted figures, i.e., motion not designated as fusion.

f. all apparent motion reported as three dimensional.

g. all apparent motion reported as two dimensional.

In all, there were fourteen sets of computations of analysis of variance for the categories listed above, namely, seven analyses for the total duration of apparent motion and seven analyses for the mean duration of apparent motion. F ratios were computed in accordance with the suggestion of Scholte (15) for determining the expectations of mean squares.

In addition to the analyses of variance, the Wilcoxon Matched-Pairs Signed-Rank Test of significance (16), was included to determine the contribution of each set of instructions and each pair of stimulus figures to the obtained F ratios in category b.

Bar graphs for representations of the effects of the fixed variables were included (Figs. 3 to 9). The ordinate indicates the maximum observation time in seconds. For each stimulus figure the total and mean duration of motion is included for each set of instructions. The sequence is maintained for all bar graphs: the blank bar represents instructions 1; the stipled bar represents

Instruction II, the horizontally striped bar represents Instruction III; and the diagonally striped bar represents Instruction IV.

Analyses of Variance and Graphs

For category a, all apparent motion perception, the analyses of variance are presented in Tables 1 and 2. The results in Table 1, for the analysis of the total duration of motion, indicated that three of the main effects were significant rate of stimulation and subjects at the .001 level, form at the .01 level. The fourth main effect, instruction, was not significant The RF interaction was significant at the .001 level. The RI and IF interactions were not significant. The RIF interaction was not significant. From Table 2, the analysis of variance for the mean duration of motion indicated significance for all of the main variables. Rate of stimulation and subjects were significant at the .001 level; instruction and form at the .01 level of significance. The RF and IF interactions were significant at the .001 and .01 levels, respectively. The RI interaction and triple interaction were not significant.

The bar graphs in Fig. 3 represent the total and mean durations of motion for the fixed variables of instruction, form and rate of stimulation for category a., i.e., all motion perception. The most consistent trend to be noted is the decrease in both the total and mean durations of apparent motion with an increase in the rate of stimulation. This trend is composed of two contradictory trends For lighted figure motion (Fig. 4) the trend is a decrease in motion for increase in rate. The reciprocal pattern of increased shadow motion perception with an increase in the rate of stimulation is indicated

TABLE 1

ANALYSIS OF VARIANCE FOR ALL MOTION PERCEPTION TOTAL TIME
(LIGHTED FIGURES AND SHADOW MOTION)

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	p
1. Rate (R)	2,196,044	2	1,097,022	R/RS	26.72	.001
2. Instruction (I)	237,708	3	79,236	I/IS	2.41	- -
3. Form (F)	159,665	9	17,741	F/FS	2.88	.01
4. Subjects (S)	3,170,978	11	288,270	S/RIFS	174.08	.001
5. R x I	21,516	6	3,586	RI/RIS	.51	- -
6. R x F	71,410	16	3,967	RF/RFS	2.06	.001
7. R x S	903,227	22	41,056			
8. I x F	47,030	27	1,742	IF/IFS	1.04	- -
9. I x S	1,084,968	33	32,676			
10. F x S	616,236	99	6,164			
11. R x I x F	67,757	54	1,255	RIF/RIFS	.76	- -
12. R x I x S	463,446	66	7,022			
13. R x F x S	380,666	196	1,923			
14. I x F x S	495,507	297	1,668			
15. R x I x F x S	983,587	594	1,696			
16. Total	10,891,730	1439	7,569			

RIANCE FOR ALL MOTION PERCEPTI
(IGHTED FIGURES AND SHADOW MOTIO)

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	p
1. Rate (R)	927,553	2	463,777	R/RS	12.78	.001
2. Instruction (I)	160,123	3	60,041	I/IS	5.42	.01
3. Form (F)	236,232	9	26,248	F/FS	5.57	.61
4. Subjects (S)	1,341,401	11	121,946	S/RIFS	58.32	.001
5. R x I	40,711	6	6,765	RI/RIS	1.21	- -
6. R x F	303,466	16	16,859	RF/RFS	6.12	.001
7. R x S	796,506	22	36,296			
8. I x F	84,012	27	3,111	IF/IFS	1.91	.01
9. I x S	365,167	33	11,066			
10. F x S	466,304	99	4,710			
11. R x I x F	97,245	54	1,801	RIF/RIFS	.86	- -
12. R x I x S	370,219	66	5,609			
13. R x F x S	545,262	156	2,754			
14. I x F x S	482,475	297	1,624			
15. R x I x F x S	1,241,906	594	2,091			
16. Total	7,480,606	1439	5,196			

in Fig. 5.

Tables 3 and 4 represent the analyses for the total and mean durations of motion, respectively, for the perception of lighted figures in motion. From Table 3, the analysis for the total duration of apparent motion indicated that all the main effects were significant. Rate of stimulation and subjects were significant at the .001 level, form, at the .01 level and instruction at the .05 level. The RF interaction was significant at the .01 level. The RI, IF, and RIF interactions were not significant. From Table 4 the main effects for the mean duration were all significant. The rate of stimulation and subjects were significant at the .001 level; instruction and form at the .01 level. The RF and IF interactions were significant at the .001 and .01 levels, respectively. The RI and RIF interactions were not significant.

The analyses for shadow motion perception, total and mean durations, are represented by Tables 5 and 6, respectively. From Table 5, the analysis for the total duration indicated that three of the main effects were significant: rate of stimulation and subjects at the .001 level, and form at the .01 level. The fixed variable of instruction was not significant. The RI, RF, IF, and RIF interactions were not significant. From Table 6, the analysis of variance for the mean duration indicated that three of the main effects were significant: subjects at the .001 level, rate of stimulation and form at the .01 level. The fourth main effect, instruction, was not significant. The RI, RF, IF, and RIF interactions were not significant.

Tables 7 and 8 represent the analyses for the total and mean

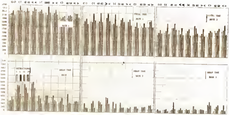


FIG 2 ALL MOTION

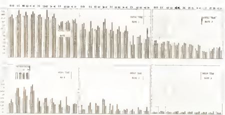
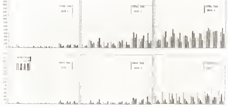

TOTAL TIME
RATE 1
TOTAL TIME
RATE 2
TOTAL TIME
RATE 3
MEAN TIME
RATE 1
MEAN TIME
RATE 2
MEAN TIME
RATE 3

FIG. [illegible]



[illegible] SHADOW MOTION

TABLE 7

ANALYSIS OF VARIANCE FOR THE PERCEPTION OF LIGHTED FIGURES IN MOTION TOTAL TIME

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	P
1. Rats (R)	6,462,481	2	3,231,241	R/RS	142.87	.001
2. Instruction (I)	153,592	3	51,197	I/IS	3.72	.05
3. Form (F)	621,656	9	69,073	F/FS	15.69	.01
4. Subjects (S)	2,340,424	11	212,766	S/RIFS	138.07	.001
5. R x I	59,419	6	9,903	RI/RIS	2.10	- -
6. R x F	80,578	18	4,476	RF/RFS	2.42	.01
7. R x S	438,998	22	19,663			
8. I x F	51,145	27	1,894	IF/IFS	1.31	- -
9. I x S	454,287	33	13,766			
10. F x S	435,717	99	4,401			
11. R x I x F	84,701	54	1,568	RIF/RIFS	1.02	- -
12. R x I x S	310,751	66	4,708			
13. R x F x S	366,337	198	1,850			
14. I x F x S	498,813	297	1,679			
15. R x I x F x S	915,532	594	1,541			
16. Total	13,272,426	1439	9,223			

TABLE 4

ANALYSIS OF VARIANCE FOR THE PERCEPTION OF LIGHTED FIGURES IN MOTION: MEAN TIME

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	p
1. Rate (R)	1,286,674	2	643,337	R/RS	17.28	.001
2. Instruction (I)	121,207	3	40,402	I/IS	5.24	.01
3. Form (F)	287,104	9	31,900	F/FS	8.82	.01
4. Subjects (S)	1,191,237	11	108,294	S/RIFS	69.46	.001
5. R x I	69,721	6	11,620	RI/RIS	2.12	- -
6. R x F	246,274	18	13,682	RF/RFS	5.79	.001
7. R x S	818,970	22	37,226			
8. I x F	76,670	27	2,840	IF/IFS	1.81	.01
9. I x S	254,604	33	7,715			
10. F x S	357,864	99	3,615			
11. R x I x F	77,853	54	1,442	RIF/RIFS	.92	- -
12. R x I x S	361,300	66	5,474			
13. R x F x S	467,909	198	2,363			
14. I x F x S	465,968	298	1,569			
15. R x I x F x S	925,999	594	1,559			
16. Total	7,009,354	1439	4,871			

TABLE 7

ANALYSIS OF VARIANCE FOR SHADOW MOTION PERCEPTION
TOTAL TIME

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	p
1 Rate (R)	1,136,073	2	568,037	R/RS	16.65	.001
2. Instruction (I)	13,573	3	4,524	I/IS	.32	- -
3. Form (F)	248,998	9	27,666	F/FS	6.42	.01
4. Subjects (S)	1,477,938	11	134,356	S/RIFS	92.72	.001
5. R x I	44,701	6	7,450	RI/RIS	1.66	- -
6. R x F	53,998	18	3,000	RF/RFS	1.54	-
7. R x S	750,677	22	34,122			
8. I x F	59,763	27	2,213	IF/IFS	1.26	- -
9. I x S	460,475	33	13,954			
10 F x S	426,625	99	4,309			
11. R x I x F	78,967	54	1,462	RIF/RIFS	1.01	- -
12. R x I x S	296,410	66	4,491			
13. R x F x S	386,337	198	1,951			
14. I x F x S	523,111	297	1,761			
15. R x I x F x S	860,808	594	1,449			
16. Total	6,818,455	1439	4,738			

TABLE 6

ANALYSIS OF VARIANCE FOR SHADOW MOTION PERCEPTION
MEAN TIME

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	P
1. Rate (R)	127,599	2	63,800	R/RS	7.32	.01
2. Instruction (I)	12,218	3	4,073	I/IS	1.10	- -
3. Form (F)	54,237	9	6,026	F/FS	4.79	.01
4. Subjects (S)	256,382	11	23,307	S/RIFS	27.95	.001
5. R x I	22,851	6	3,809	RI/RIS	1.37	- -
6. R x F	13,508	18	750	RF/RFS	.82	- -
7. R x S	191,519	22	8,705			
8. I x F	14,464	27	536	IF/IFS	.53	- -
9. I x S	122,557	33	3,714			
10. F x S	124,486	99	1,257			
11. R x I x F	58,731	54	1,088	RIF/RIFS	1.30	- -
12. R x I x S	183,979	66	2,788			
13. R x F x S	237,861	198	1,201			
14. I x F x S	298,760	297	1,006			
15. R x I x F x S	495,451	594	834			
16. Total	2,215,603	1439	1,540			

TABLE 7

ANALYSIS OF VARIANCE FOR THE PERCEPTION OF ONE LIGHTED FIGURE IN MOTION: TOTAL TIME (LIGHTED FIGURES PERCEIVED AS ONE LIGHTED FIGURE IN MOTION)

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	P
I. Rate (R)	6,059,I45	2	3,029,574	R/RS	I13.77	.00I
2. Instruction (I)	171,478	3	57,159	I/IS	5.I9	.0I
3. Form (F)	858,857	9	95,184	F/FS	21.38	.001
4. Subjects (S)	3,579,686	11	325,426	S/RIFS	19I.09	.00I
5. R x I	57,498	6	9,583	RI/RIS	1.66	- -
6. R x F	92,960	18	5,164	RF/RFS	2.48	.0I
7. R x S	585,854	22	28,630			
8. I x F	68,762	27	2,547	IF/IFS	I.20	- -
9. I x S	363,485	33	11,015			
10. F x S	440,804	95	4,453			
11. R x I x F	95,II5	54	1,76I	RIF/RIFS	1.03	- -
12. R x I x S	380,084	66	5,755			
13. R x F x S	412,497	198	2,083			
14. I x F x S	630,811	297	2,124			
15. R x I x F x S	1,011,622	594	1,703			
18. Total	14,806,460	1439	10,289			

TABLE 8

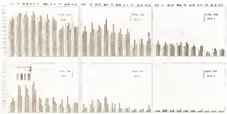
ANALYSIS OF VARIANCE FOR THE PERCEPTION OF ONE LIGHTED FIGURE IN MOTION MEAN TIME (LIGHTED FIGURES PERCEIVED AS ONE LIGHTED FIGURE IN MOTION)

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	P
1. Rate (R)	1,383,777	2	691,889	R/RS	19.09	.001
2. Instruction (I)	125,519	3	41,840	I/IS	5.28	.01
3. Form (F)	400,236	9	44,471	F/FS	12.10	.01
4. Subjects (S)	1,145,361	11	104,124	S/RIFS	61.10	.001
5. R x I	85,257	6	14,209	RI/RIS	2.75	.05
6 R x F	273,576	18	15,199	RF/RFS	6.41	.001
7. R x S	797,540	22	36,252			
8. I x F	83,200	27	3,081	IF/IFS	1.94	.01
9. I x S	261,634	33	7,928			
10. F x S	363,964	99	3,676			
11 R x I x F	97,766	54	1,810	RIF/RIFS	1.06	- -
12. R x I x S	340,637	66	5,161			
13. R x F x S	469,284	198	2,370			
14. I x F x S	472,389	298	1,590			
15. R x I x F x S	1,011,840	594	1,704			
16. Total	7,312,085	1439	5,081			

durations of motion for the perception of one lighted figure in motion. From Table 7, the analysis for the total duration of motion indicated that all the main effects were significant. Rate of stimulation, form, and subjects were significant at the .001 level; instruction at the .01 level. The RF interaction was significant at the .01 level. The RI, IF and RIF interactions were not significant. From Table 8, the analysis for the mean duration of motion indicated that all the main effects were significant rate of stimulation and subjects at the .001 level, instruction and form at the .01 level. The RI, RF and IF interactions were significant at the .05, .001 and .01 levels, respectively The RIF interaction was not significant.

The bar graphs represented in Fig. 6 indicate the total and mean durations for the perception of one lighted figure in motion The pattern of decreased total and mean durations of motion with an increase in the rate of stimulation is repeated. In addition there appears to be a trend toward a leveling of the effects of instruction and form under Rate 3. The trend toward decreased total and mean durations of motion for the closure group (see Fig. 2) may be noted under Rates 1 and 2.

Tables 9 and 10 represent the analyses for the total and mean durations of motion in the perception of the unfused lighted figures in motion. From Table 9, the analysis for the total duration of motion indicated that the main effect, subjects, was significant at the .001 level. Rate of stimulation, instruction, and form were not significant. The RI, RF, IF and RIF interactions were not significant. From Table 10, an analysis for the mean duration of motion indicated that the


TOTAL TIME
RATE 1
TOTAL TIME
RATE 2
TOTAL TIME
RATE 3
MEAN TIME
RATE 1
MEAN TIME
RATE 2
MEAN TIME
RATE 3

[illegible]

TABLE 9

ANALYSIS OF VARIANCE FOR THE PERCEPTION OF LIGHTED FIGURES IN MOTION: TOTAL TIME (PERCEIVED MOTION OF TWO LIGHTED FIGURES IN MOTION)

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	P
1. Rate (R)	13,867	2	6,934	R/RS	.45	- -
2. Instruction (I)	10,928	3	3,643	I/IS	.79	- -
3 Form (F)	32,061	9	3,562	F/FS	1.36	- -
4. Subjects (S)	1,071,465	11	97,406	S/RIFS	115.27	.001
5. R x I	8,578	6	1,430	RI/RIS	.68	- -
6. R x F	29,175	18	1,621	RF/RFS	1.61	- -
7. R x S	335,516	22	15,251			
8. I x F	41,117	27	1,523	IF/IFS	1.26	- -
9. I x S	152,805	33	4,630			
10. F x S	258,952	99	2,616			
11. R x I x F	49,456	54	916	RIF/RIFS	1.08	- -
12 R x I x S	137,613	66	2,085			
13. R x F x S	198,865	198	1,004			
14 I x F x S	359,910	297	1,212			
15. R x I x F x S	501,906	594	845			
16. Total	3,202,213	1439	2,225			

TABLE 10

ANALYSIS OF VARIANCE FOR THE PERCEPTION OF LIGHTED FIGURES IN MOTION MEAN TIME (PERCEIVED MOTION OF TWO LIGHTED FIGURES IN MOTION)

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	P
1. Rate (R)	2,118	2	1,059	R/RS	1.22	- -
2. Instruction (I)	1,122	3	374	I/IS	.78	- -
3. Form (F)	7,106	9	790	F/FS	1.87	- -
4. Subjects (S)	70,873	11	6,443	S/RIFS	21.48	.001
5. R x I	2,426	6	404	RI/RIS	1.18	- -
6. R x F	3,996	18	222	RF/RFS	1.10	- -
7. R x S	19,091	22	868			
8. I x F	6,667	27	247	IF/IFS	1.25	- -
9. I x S	15,763	33	478			
10. F x S	41,696	99	422			
11. R x I x F	13,215	54	245	RIF/RIFS	.82	- -
12. R x I x S	22,587	66	342			
13. R x F x S	9,827	198	201			
14. I x F x S	58,782	297	198			
15. R x I x F x S	178,054	594	300			
16. Total	483,324	1439	336			

main effect, subjects, was significant at the .001 level. Rate of stimulation, instruction, and form were not significant. The RI, RF, IF and RIF interactions were not significant.

The bar graphs in Fig. 7 represent the total and mean durations of motion in the perception of the unfused lighted figures in motion. No consistent pattern was indicated for any of the fixed variables.

Tables 11 and 12 represent the analyses for the total and mean durations of motion for the perception of three dimensional motion. In Table 11, the analysis for the total duration of motion indicated that all the main effects were significant: form and subjects at the .001 level, rate of stimulation and instruction at the .01 level. The RF and IF interactions were significant at the .001 and .05 levels, respectively. The RI and RIF interactions were not significant. From Table 12, the analysis for the mean duration indicated that three of the main effects were significant: rate of stimulation and subjects at the .001 level, form at the .01 level. The main effect, instruction, was not significant. The RF interaction was significant at the .001 level. The RI, IF, and RIF interactions were not significant.

The bar graphs in Fig. 8 represent the total and mean durations of motion for the perception of three dimensional motion. The pattern of decreased total and mean durations of motion with an increase in the rate of stimulation may be noted. In addition a second pattern appears to be consistent for both the total and the mean durations of motion. Proximal figures induced the greatest amount of three dimensional motion; closure figures induced the next greatest amount. Similar figures and the circles failed to induce any appreciable

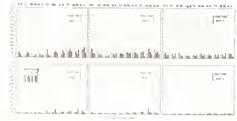

TOTAL TIME
RATE
TOTAL TIME
RATE 2
TOTAL TIME
RATE 3
INTERACTIONS
MEAN TIME
RATE
MEAN TIME
RATE 3

TABLE 11

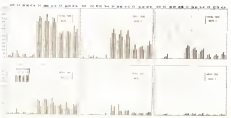
ANALYSIS OF VARIANCE FOR THE PERCEPTION OF THREE DIMENSIONAL MOTION OF LIGHTED FIGURES: TOTAL TIME

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	p
1. Rate (R)	2,065,215	2	103,261	R/RS	9.14	.01
2. Instruction (I)	80,956	3	26,985	I/IS	7.79	.01
3. Form (F)	4,285,029	9	476,114	F/FS	45.21	.001
4. Subjects (S)	866,454	11	78,769	S/RIFS	51.95	.001
5. R x I	12,494	6	2,082	RI/RIS	.55	- -
6. R x F	1,129,644	18	62,758	RF/RFS	31.15	.001
7. R x S	248,519	22	11,296			
8. I x F	70,765	27	2,621	IF/IFS	1.59	.05
9. I x S	186,027	33	5,637			
10. F x S	1,042,536	99	10,531			
11. R x I x F	71,480	54	1,324	RIF/RIFS	.87	- -
12. R x I x S	251,424	66	3,809			
13. R x F x S	398,935	198	2,015			
14. I x F x S	489,456	297	1,648			
15. R x I x F x S	900,615	594	1,516			
16. Total	12,099,544	1439	8,408			

TABLE 12

ANALYSIS OF VARIANCE FOR THE PERCEPTION OF THREE DIMENSIONAL MOTION OF LIGHTED FIGURES: MEAN TIME

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	P
1 Rate (R)	280,190	2	140,095	R/RS	15.09	.001
2 Instruction (I)	26,179	3	8,726	I/IS	2.52	- -
3. Form (F)	279,944	9	31,105	F/FS	13.89	.01
4. Subjects (S)	216,739	11	19,704	S/RIFS	24.75	.001
5. R x I	19,368	6	3,228	RI/RIS	1.82	- -
6. R x F	149,513	18	8,306	RF/RFS	5.57	.001
7. R x S	204,239	22	9,284			
8. I x F	22,642	27	839	IF/IFS	1.05	- -
9. I x S	114,500	33	3,470			
10. F x S	221,620	99	2,239			
11. R x I x F	42,304	54	783	RIF/RIFS	.98	- -
12. R x I x S	116,811	66	1,770			
13. R x F x S	295,336	198	1,492			
14. I x F x S	237,102	297	798			
15. R x I x F x S	472,896	594	796			
16. Total	2,699,376	1439	1,876			


TOTAL TIME
RATE
TOTAL TIME
RATE 2
TOTAL TIME
RATE 3
MEAN TIME
MEAN TIME
RATE
MEAN TIME
RATE 3

amounts of three dimensional motion.

Tables 13 and 14 represent the analyses for total and mean durations of motion, respectively, for the perception of two dimensional motion. In Table 13, the analysis for the total duration of motion indicated that three of the main effects, rate of stimulation, form and subjects, were significant at the .001 level. Instruction was not significant. The RF and IF interactions were significant at the .001 level. The RI and RIF interactions were not significant. In Table 14, the analysis for the mean duration of motion indicated that all of the main effects were significant: rate of stimulation and subjects at the .001 level, instruction and form at the .01 level. The RF and IF interactions were significant at the .001 and .01 levels, respectively. The RI and RIF interactions were not significant.

The bar graph for two dimensional motion (Fig. 3) represents the total and mean durations of motion. Two patterns appear to be consistent. Both for total and mean durations of motion there is a decrease of duration with an increase in the rate of stimulation. In addition the Similar figures and the Complete Circles (see Fig. 2) appear to yield the major portion of perceived two dimensional motion.

Analysis with the Wilcoxon Matched-Pairs Signed-Rank Test

The data represented in Tables 3 and 4 and in Fig. 4 constitute the basic data in any study of apparent motion. The data included all perceptions of lighted figures in motion regardless of the qualitative aspects. The Wilcoxon Test was computed to determine the separate effects of the four sets of instructions, and the effects of the

TABLE 13

ANALYSIS OF VARIANCE FOR THE PERCEPTION OF TWO DIMENSIONAL MOTION OF LIGHTED FIGURES: TOTAL TIME

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	p
1. Rate (R)	1,247,486	2	623,743	R/RS	42.50	.001
2. Instruction (I)	41,251	3	13,750	I/IS	2.04	- -
3. Form (F)	6,014,036	9	668,226	F/FS	58.41	.001
4. Subjects (S)	1,131,252	11	102,841	S/RIFS	58.77	.001
5. R x I	40,162	6	6,694	RI/RIS	1.73	- -
6. R x F	1,108,231	18	61,568	RF/RFS	28.27	.001
7. R x S	322,894	22	14,677			
8. I x F	120,955	27	4,480	IF/IFS	2.33	.001
9. I x S	222,761	33	6,750			
10. F x S	1,132,638	99	11,441			
11. R x I x F	83,863	54	1,553	RIF/RIFS	.89	- -
12. R x I x S	255,045	66	3,864			
13. R x F x S	431,249	198	2,178			
14. I x F x S	571,984	297	1,926			
15. R x I x F x S	1,039,331	594	1,750			
16. Total	13,763,158	1439	9,584			

TABLE 14

ANALYSIS OF VARIANCE FOR THE PERCEPTION OF TWO DIMENSIONAL MOTION OF LIGHTED FIGURES: MEAN TIME

Source of Variance	Sum of Squares	df	Mean Square	F Ratio	F	P
1. Rate (R)	578,909	2	289,455	R/RS	16.39	.001
2. Instruction (I)	48,144	3	16,048	I/IS	5.79	.01
3. Form (F)	709,658	9	78,851	F/FS	12.64	.01
4. Subjects (S)	683,626	11	62,148	S/RIFS	47.08	.001
5. R x I	31,224	6	5,204	RI/RIFS	1.40	- -
6. R x F	546,937	18	30,496	RF/RFS	10.60	.001
7. R x S	388,545	22	17,661			
8. I x F	92,732	27	3,435	IF/IFS	2.05	.01
9. I x S	91,445	33	2,771			
10 F x S	617,338	99	6,236			
11. R x I x F	64,225	54	1,189	RIF/RIFS	.90	- -
12. R x I x S	245,502	66	3,720			
13. R x F x S	570,709	198	2,882			
14. I x F x S	497,932	297	1,677			
15. R x I x F x S	784,156	594	1,320			
16. Total	5,953,082	1439	4,137			

TOTAL TIME
TOTAL TIME
TOTAL TIME

separate pairs of stimulus figures as the overall tests, i.e., F ratios. The bar graphs in Fig. 4 appeared to have a consistent pattern of relatively longer total and mean durations under Instruction III. The graphs further indicated different patterns of effectiveness of the fixed variables when the total and mean durations were compared. The trends suggested by inspection of these bar graphs were tested with the Wilcoxon Test. The results are presented in Tables 15 to 20.

Instruction

Table 15 represents the significance levels, alpha, obtained in comparing the total duration of motion under the four sets of instructions, for each rate of stimulation, and for each pair of stimulus figures. Twenty-six of the one hundred and eighty comparisons were significant.

The comparison of Instruction I with Instruction II yielded one significant difference at the .05 level. Obtaining one or two significant differences in thirty comparisons may be attributed to chance. Differences in obtained data due to formal changes in instruction to the subjects were not found.

In comparing the motion perception under Instruction I with the same effects under Instruction III, ten significant differences were obtained. This is more than may be expected by chance in thirty comparisons. It may be stated that Instruction I differs significantly from Instruction III.

The comparison of Instruction I with Instruction IV yielded no significant difference.

The comparison of Instruction II with Instruction III yielded

TABLE 13

THE WILCOXON MATCHED-PAIRS SIGNED-RANK SIGNIFICANCE LEVELS ON THE DIFFERENCES BETWEEN SETS OF INSTRUCTIONS UNDER CATEGORY B (PERCEPTION OF LIGHTED FIGURES IN MOTION TOTAL TIME)

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10 *
Rate 1 M I - M II	-	-	-	-	-	-	-	-	-	-
Rate 2 M I - M II	-	-	-	.05	-	-	-	-	-	-
Rate 3 M I - M II	-	-	-	-	-	-	-	-	-	-
Rate 1 M I - M III	-	.01	-	.05	-	01	.02	-	-	-
Rate 2 M I - M III	-	.01	-	.02	.01	-	-	-	-	.05
Rate 3 M I - M III	.05	.05	-	-	-	-	-	-	-	-
Rate 1 M I - M IV	-	-	-	-	-	-	-	-	-	-
Rate 2 M I - M IV	-	-	-	-	-	-	-	-	-	-
Rate 3 M I - M IV	-	-	-	-	-	-	-	-	-	-
Rate 1 M II - M III	-	05	-	.05	-	.01	-	-	-	-
Rate 2 M II - M III	-	.05	.01	-	.05	-	-	-	-	.01
Rate 3 M II - M III	-	-	-	-	-	-	01	-	-	-
Rate 1 M II - M IV	-	-	-	-	-	-	-	-	-	-
Rate 2 M II - M IV	05	-	-	-	-	-	-	-	-	-
Rate 3 M II - M IV	-	-	-	-	-	-	.05	-	-	-
Rate 1 M III - M IV	-	-	-	-	-	01	-	-	-	-
Rate 2 M III - M IV	.05	.05	-	02	-	-	-	.01	-	-
Rate 3 M III - M IV	-	-	-	-	-	-	-	-	-	-

---

* F1 represents the pair of complete circles.

F2, F3, F4 represent the half circles, open-sided squares, and open-sided triangles, respectively, arranged as similar figures (Fig.2).

F5, F6, F7 represent the half circles, open-sided squares, and open-sided triangles, respectively, arranged as proximal figures (Fig 2).

F8, F9, F10 represent the half circles, open-sided squares, and open-sided triangles, respectively, arranged as closure figures (Fig.2).

eight significant differences in thirty pairings. Instruction III may be considered significantly different from Instruction II.

The comparison of Instruction II with Instruction IV yielded two significant differences. Since this may be attributed to chance factors, Instruction II may be considered not different from Instruction IV.

The comparisons involving Instruction III and Instruction IV yielded five significant differences. Instruction III may be considered as significantly different from Instruction IV.

Further inspection of the alpha values in Table 15 indicated that the effect of Instructions to the subject was not significant at the fastest rate, Rate 3. The contribution to the significant F ratio obtained for instruction appears to be derived primarily from the effect of Instruction III.

Table 16 represents the significance levels, alpha, obtained in comparing the mean duration of motion for the four sets of instructions. Comparisons were computed for each rate of stimulation and for each pair of stimulus figures. Twenty-five significant differences were obtained in one hundred and eighty comparisons. Comparisons of Instructions I and II yielded nine significant differences. It was concluded that for the mean duration of apparent motion Instructions I and II were significantly different.

The comparisons of Instruction I with Instruction III yielded nine significant differences. It was concluded that Instruction I differed significantly from Instruction III. The mental set or attitude of inducing motion in the observer appeared to affect the

TABLE 16

THE WILCOXON MATCHED-PAIRS SIGNED-RANK SIGNIFICANCE LEVELS ON THE DIFFERENCES BETWEEN SETS OF INSTRUCTIONS UNDER CATEGORY B. (PERCEPTION OF LIGHTED FIGURES IN MOTION: MEAN TIME.)

		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10 *
Rate 1	M I - M II	-	-	-	.01	-	-	-	-	-	-
Rate 2	M I - M II	-	-	01	01	.01	.01	.05	.02	.01	-
Rate 3	M I - M II	-	02	-	-	-	-	-	-	-	-
Rate 1	M I - M III	-	.05	-	.01	-	-	-	-	-	-
Rate 2	M I - M III	.01	01	01	.01	.05	.01	-	.01	-	-
Rate 3	M I - M III	-	-	-	-	-	-	-	-	-	-
Rate 1	M I - M IV	-	-	-	-	-	-	-	-	-	-
Rate 2	M I - M IV	-	-	-	-	-	-	-	-	-	-
Rate 3	M I - M IV	-	-	-	-	-	-	-	-	-	-
Rate 1	M II - M III	-	-	-	-	-	-	-	-	-	-
Rate 2	M II - M III	-	-	-	-	-	-	-	-	-	-
Rate 3	M II - M III	-	-	-	-	-	-	-	-	.05	-
Rate 1	M II - M IV	-	-	.05	-	-	-	-	-	-	-
Rate 2	M II - M IV	-	-	-	05	-	.05	-	-	-	-
Rate 3	M II - M IV	-	-	-	-	-	-	-	-	-	-
Rate 1	M III - M IV	-	-	-	-	-	.05	-	-	-	-
Rate 2	M III - M IV	-	.01	-	-	-	-	-	.01	-	-
Rate 3	M III - M IV	-	-	-	-	-	-	-	-	-	-

* F1 represents the pair of complete circles

F2, F3, F4 represent the half circles, open-sided squares, and open-sided triangles, respectively, arranged as similar figures (Fig 2)

F5, F6, F7 represent the half circles open-sided squares, and open-sided triangles, respectively, arranged as proximal figures (Fig 2)

F8, F9, F10 represent the half circles open-sided squares, and open-sided triangles, respectively, arranged as closure figures (Fig 2) perception of motion.

No significant differences were obtained when instruction I was compared with Instruction IV. The mental set of inhibiting motion in the observer was not effective in reducing the mean duration of apparent motion.

Only one significant difference was obtained when Instruction II was compared with instruction III. This single difference may be considered to be a chance occurrence. Instructions II and III were not considered to be significantly different

The comparisons of instruction II with Instruction IV yielded three significant differences. It was concluded that these particular instructional changes significantly effected the perception of apparent motion.

The comparisons involving changes of attitude and/or mental set, i.e., Instruction III and Instruction IV, yielded three significant differences, and it was concluded that these changes of attitude and/or mental set were determinants of apparent motion.

Further inspection of the significant differences found in Table 16 indicated that the effect of instructional changes was greatest for a specific rate, Rate 2. Eighteen of the twenty-five significant differences were obtained under Rate 2. The effect of instructional changes appeared to drop out at the fastest rate, i.e., Rate 3, for mean as well as for total duration of motion.

Form

The Wilcoxon Test was used to determine the contributions of the various figure combinations to the significant F ratio. Tables

17 to 20 represent the obtained significant differences for the two pairs of stimulus figures under each set of instructions for every rate of stimulation. The stimulus figure comparisons were computed for both total and mean durations of apparent motion. F1 designates the pair of complete circles. F2, F3, and F4 represent the half-circles, open-sided squares, and open-sided triangles, respectively, arranged as similar figures. F5, F6, and F7 represent the half-circles, open-sided squares, and open-sided triangles, respectively, arranged as closure figures.

In Table 17 the significance levels, alpha, for the stimulus figure comparisons are given for both total and mean durations under Instruction 1. The computations for the total duration of motion, Rate 1, indicated that the half-circles and open-sided squares of the closure group accounted for all of the significant differences obtained. For Rate 2, all stimulus figures in the closure group were significantly different from all other stimulus figures. The computations under Rate 3 indicated that the open-sided squares and the open-sided triangles were involved in nine of the twelve obtained significant differences.

Inspection of the computations of mean duration of motion in Table 17 indicated that the effect of figural relationships was confined to observations under Rate 1. The obtained differences were restricted to the open-sided squares and the open-sided triangles of the closure group. These stimulus figures accounted for six of the seven obtained differences. The data in Table 17 suggest that the stimulus figures in the closure group contributed most heavily to the

TABLE 17

THE WILCOXON MATCHED-PAIRS SIGNED-RANK SIGNIFICANCE LEVELS ON THE DIFFERENCE BETWEEN PAIRS OF STIMULUS FIGURES OBSERVED UNDER INSTRUCTION 1. LEVELS OF SIGNIFICANCE ARE INCLUDED FOR 6-TH TOTAL AND MEAN TIME FOR EACH RATE OF STIMULATION

Instruction 1 Total Time

Rate 1

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	-	-	-	-	-	-	-
F2		-	-	-	-	-	-	.01	.05	-
F3			-	-	-	-	-	.05	.01	-
F4				-	-	-	-	-	-	-
F5					-	-	-	.05	.01	-
F6						-	-	.05	.01	-
F7							-	-	.05	-
F8								-	-	.02
F9									-	-

Rate 2

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	-	-	-	-	.01	.05	.05
F2		-	-	-	-	-	-	.01	-	-
F3			-	-	-	.01	-	.01	.05	.02
F4				-		-	-	.01	.05	-
F5					-	-	-	.02	-	-
F6						-	-	.02	-	-
F7							-	.01	.05	.05
F8								-	-	-
F9									-	-

Rate 3

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10 *
F1	-	-	-	-	-	-	-	.05	-	-
F2		-	.02	-	-	-	-	-	-	-
F3			-	-	-	.02	.04	.02	.01	.02
F4				-	-	.01	.01	.05	.05	-
F5					-	-	-	-	-	-
F6						-	-	-	-	-
F7							-	-	-	-
F8								-	-	.01
F9									-	-

Instruction I Mean Time

Rate 1

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	-	-	-	-	-	.05	-
F2		-	-	.05	-	-	-	-	-	.05
F3			-	-	-	-	-	-	.02	.01
F4				-	-	-	-	-	-	.05
F5					-	-	-	-	-	-
F6						-	-	-	-	-
F7							-	-	.02	-
F8								-	-	-
F9									-	-

Rate 2

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	-	-	-	-	-	-	-
F2		-	-	-	-	-	-	-	-	-
F3			-	-	-	-	-	-	-	-
F4				-	-	.02	-	-	.05	-
F5					-	-	-	-	-	-
F6						-	-	-	-	-
F7							-	-	-	-
F8								-	-	-
F9									-	-

Rate 3

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	-	-	-	-	-	-	-
F2		-	-	-	-	-	-	-	-	-
F3			-	-	-	-	-	-	-	-
F4				-	-	-	-	-	-	-
F5					-	-	-	-	-	-
F6						-	-	-	-	-
F7							-	-	-	-
F8								-	-	.02
F9									-	-

F1 complete circles. F2, F3, F4 similar figures. F5, F6, F7 proximal figures. F8, F9, F10 closure figures.
The stimulus figure sequence is indicated in Fig. 4

overall significant F ratio. In addition, it was noted that the effect of form tended to diminish, as the rate of stimulation increased, when measured by the mean duration of motion.

In Table 18 the data represent the comparison of stimulus figures for total and mean durations of motion under instruction II. For the computation of differences for total time under Rate 1, the stimulus figures in the closure group were involved in eleven of the twelve significant differences obtained. The computations for Rate 2 and Rate 3 indicated that the closure group figures contributed the greatest proportion of significant differences. It may be concluded that the closure group is significantly different from the similar, proximal, and complete circle figures. For mean duration the computations under Instruction II for Rate 1 indicated that the similar figures differed significantly from the closure, proximal, and complete circle figures. The number of overall significant differences again diminishes as the rate of stimulation is increased. For Rate 2, the closure group figures were involved in eleven of the fifteen obtained differences. Under Rate 3, form does not appear to be an effective variable when measured by the mean duration of apparent motion.

In Table 19 the data represent significance levels, alpha, for total and mean durations of motion under Instruction III. For the total duration of motion the closure figures appear to be significantly different from the similar, proximal, and complete circle figures for all rates of stimulation. When the mean duration of motion was used as a basis for comparison, the similar figures were found to be significantly different from all other figure combinations under Rate 1.

TABLE 18

THE WILCOXON MATCHED-PAIRS SIGNED-RANK SIGNIFICANCE LEVELS ON THE DIFFERENCE BETWEEN PAIRS OF STIMULUS FIGURES OBSERVED UNDER INSTRUCTION II. LEVELS OF SIGNIFICANCE ARE INCLUDED FOR BOTH TOTAL AND MEAN TIME FOR EACH RATE OF STIMULATION.

Instruction II: Total Time

Rate 1

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	-	-	-	-	.02	.05	-
F2		-	-	-	-	-	-	.05	.05	-
F3			-	-	-	-	-	-	-	-
F4				-	-	-	-	.01	.01	.05
F5					-	.05	-	.05	.02	.05
F6						-	-	-	-	-
F7							-	.02	-	-
F8								-	-	-
F9									-	-

Rate 2

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	-	-	.05	.05	.01	.01	.01
F2		-	-	-	-	-	-	.01	-	.05
F3			-	.05	-	-	-	.01	-	.05
F4				-	-	-	.05	.01	.02	.01
F5					-	-	-	.01	-	-
F6						-	-	.01	.05	-
F7							-	.01	-	.05
F8								-	.05	-
F9									-	.01

Rate 3

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10*
F1	-	-	-	-	-	-	.02	.01	.02	.05
F2		-	-	-	-	-	.01	.02	.05	.05
F3			-	-	-	-	.02	.01	.01	.02
F4				-	-	-	-	-	-	-
F5					-	-	-	.05	-	-
F6						-	-	.02	.05	-
F7							-	-	-	-
F8								-	-	-
F9									-	-

Instruction II: Mean Time

Rate 1

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	.01	.01	.01	.05	-	-			
F2		-	-	-	-	-	-	.01	.05	.05
F3			-	-	-	.02	-	.02	-	.01
F4				-	-	.05	.02	.01	.05	.01
F5					-	-	-	.02	-	-
F6						-	-	-	-	-
F7							-	.05	-	.05
F8								-	.05	-
F9									-	-

Rate 2

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	.05	-	-	-	-	-	-
F2		-	-	-	-	-	-	-	-	.02
F3			-	-	-	-	.02	.05	.05	.02
F4				-	-	-	.02	.02	.05	.02
F5					-	-	.05	.05	-	.05
F6						-	-	.05	-	-
F7							-	-	-	.05
F8								-	-	-
F9									-	-

Rate 3

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	-	-	-	-	-	-	-
F2		-	-	-	-	-	.05	-	-	-
F3			-	-	-	-	.02	-	-	-
F4				-	-	-	-	-	-	-
F5					-	-	-	-	-	-
F6						-	-	-	-	-
F7							-	-	-	-
F8								-	-	-
F9									-	-

*F1 complete circles F2, F3, F9 similar figures; F6, F8, F7 proximal figures; F4, F5, F10 closure figures
The stimulus figure sequence is indicated in Fig. 4.

TABLE 19

THE WILCOXON MATCHED-PAIRS SIGNED-RANK SIGNIFICANCE LEVELS ON THE DIFFERENCE BETWEEN PAIRS OF STIMULUS FIGURES OBSERVED UNDER INSTRUCTION III. LEVELS OF SIGNIFICANCE ARE INCLUDED FOR BOTH TOTAL AND MEAN TIME FOR EACH RATE OF STIMULATION.

Instruction III: Total Time

Rate 1

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1		.08		.05	-	.01	-	.05	-	-
F2		-	-	-	-		-	.01	.02	.01
F3			-	-	-	-	-	.05	-	.05
F4				-	-	-	-	.02	.02	.01
F5					-	.05	-	.02	-	-
F6							.02	.01	.01	.01
F7							-	.02	-	.01
F8								-		-
F9									-	-

Rate 2

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	-	-	-	-	.01	.02	-
F2		-	-	-	-	-	-	.01	.01	.05
F3				-	-	-	-	.05	.05	-
F4				-	-	.05	-	.01	.01	.05
F5					-	-	-	.02	.01	-
F6						-	-	-	-	-
F7							-	-	-	[illegible]
F8								-	-	[illegible]
F9									-	[illegible]

Rate 3

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10 *
F1	-	-	-	-	-	-	-	.01	[illegible]	-
F2		-	[illegible]	-	[illegible]	-	.05	.02	.01	.05
F3			-	-	[illegible]	-	-	.01	.05	-
F4				[illegible]	[illegible]	[illegible]	[illegible]	.01	.02	[illegible]
F5					-	[illegible]	[illegible]	.01	.02	[illegible]
F6						-	[illegible]	[illegible]	[illegible]	[illegible]
F7							[illegible]	[illegible]	[illegible]	[illegible]
F8								-	-	[illegible]
F9									-	-

Instruction III: Mean Time

Rate 1

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	.01	.05	.01	-	-	-	-		-
F2		-		-	.05	.05	.01	.01	.01	.01
F3				-	.05	.05	.01	.05	.01	.01
F4					.05	.05	.01	.01	.01	.01
F5					-	-		-		-
F6						-	.02	-	.02	.01
F7							-	-	-	-
F8								-	-	-
F9									-	-

Rate 2

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	.05	-	.05	-	[illegible]	[illegible]	[illegible]	-	-
F2		-	-	[illegible]	.01	-	[illegible]	.02	.01	.01
F3			-		-	-	[illegible]	.01	.05	
F4				-	.01	-	[illegible]	[illegible]	.01	.05
F5					-	-	-	-	-	-
F6						-	-	-	-	-
F7							-	-	-	-
F8								-	-	-
F9									-	-

Rate 3

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	-	[illegible]	[illegible]
F2		[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
F3			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F4				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F5					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F6						-	-	-	[illegible]	[illegible]
F7							-	-	-	[illegible]
F8								[illegible]	[illegible]	[illegible]
F9									[illegible]	[illegible]

[illegible] F3, F4 similar figures [illegible]
[illegible] order is indicated in [illegible]

Under Rates 2 and 3, the number of significant differences tended to decrease with the increase in the rate of stimulation.

Table 20 represents the computations for stimulus figure comparisons under Instruction IV. The pattern of obtained differences is similar to that found under the other sets of instructions. That is, the closure group figures are significantly different for all rates of stimulation when the total duration of motion was the basis of comparison. The data for the mean duration in Table 20 indicated that the effect of form diminishes as the rate increases. For Rate 1 the similar figures were significantly different from all other figure combinations. Under Rate 2, the similar figures again account for all obtained significant differences. Changes in the stimulus figures were not effective in the determination of apparent motion under Rate 3 when measured by the mean duration of motion.

To summary the effect on the total duration of motion, of instructions to the subjects appeared to be derived primarily from the effect of Instruction III. Twenty-three of the twenty-six obtained significant differences were found in comparisons involving Instruction III. That is, the mental set of facilitating motion appeared to be an effective variable in the determination of apparent motion. The mental set of inhibiting apparent motion does not appear to be effective. A change in the formal instructions to the subjects was not an effective variable in apparent motion when measured by the total duration of motion. The effect of instructions to the subject appears to diminish under Rate 3. Only four of the twenty-six significant differences were obtained under Rate 3.

TABLE 28

THE WILCOXON MATCHED-PAIRS SIGNED-RANK SIGNIFICANCE LEVELS ON THE DIFFERENCE BETWEEN PAIRS OF STIMULUS FIGURES OBSERVED UNDER INSTRUCTION IV. LEVELS OF SIGNIFICANCE ARE INCLUDED FOR BOTH TOTAL AND MEAN TIME FOR EACH RATE OF STIMULATION

Instruction IV: Total Time

Rate 1

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	.02	-	.05	-	-	-	-	-	-
F2		[illegible]	-	[illegible]	-	-	-	.01	.01	.01
F3			-	-	-	-	-	.01	.01	.01
F4				-	-	-	-	.01	.01	.01
F5					-	-	-	-	-	-
F6						-	-	-	.02	.02
F7							-	-	-	-
F8								-	-	-
F9									-	-

Rate 2

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	-	-	-	-	.01	.01	.01
F2		-	-	-	-	-	-	.01	.01	.01
F3			-	-	-	-	-	.01	.01	.01
F4				-	-	-	-	.01	.01	.02
F5					-	-	-	.02	.01	-
F6						-	-	.01	.01	.02
F7							-	.01	.01	.01
F8								-	-	.01
F9									-	.05

Rate 3

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10*
F1	-	-	-	-	-	-	-	.01	-	.05
F2		-	-	-	-	-	-	.01	.05	.01
F3			-	-	-	-	-	.02	-	.05
F4				-	-	-	-	.05	-	.05
F5					-	-	-	.05	.05	.01
F6						-	-	-	-	.05
F7							-	.05	.05	-
F8								-	-	-
F9									-	-

Instruction IV Mean Time

Rate 1

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	[illegible]	-	.01	-	-	-	-	-	-
F2		-	-	-	.02	.02	-	.02	.01	.01
F3			[illegible]	-	-	.05	.05	.01	.02	.01
F4				-	.01	.01	.02	.02	.01	.01
F5					-	-	-	-	-	-
F6						-	-	-	-	-
F7							-	-	-	-
F8								-	-	-
F9									-	-

Rate 2

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	.02	-	-	-	-	-	-
F2		-	-	-	-	.01	-	.02	-	-
F3			-	-	-	.01	-	.02	-	.05
F4				-	-	.05	-	.02	-	-
F5					-	-	-	-	-	-
F6						-	-	-	-	-
F7							-	-	-	-
F8								-	-	-
F9									-	-

Rate 3

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	-	-	.05	-	-	-	-	-	-
F2		-	-	-	-	-	[illegible]	-	-	[illegible]
F3			-	-	-	-	[illegible]	[illegible]	-	-
F4				-	-	-	[illegible]	[illegible]	[illegible]	[illegible]
F5					-	-	-	-	-	-
F6						-	-	-	-	[illegible]
F7							-	[illegible]	-	-
F8								-	-	-
F9									-	-

*F1 complete circles. F2, F3, F4 similar figures. F5, F6 F7 proximal figures. F8, F9, F10 closure figures.
The stimulus figure sequence is indicated in Fig. 4.

A change in formal instructions to the subjects was an effective variable in the perception of motion when measured by the mean duration of motion (Table 16). The mental set of facilitating apparent motion appeared to effect significantly the perception of motion when measured by the mean duration of motion. The mental set of inhibiting apparent motion was not effective. Further inspection of the significant differences found in Table 16 indicated that the effect of instructional changes was greatest under a specific rate of stimulation, Rate 2. The effect of instructional changes appeared to drop out at the fastest rate, i.e., Rate 3, for the mean as well as for the total duration of motion.

Inspection of the significant differences obtained in Tables 17 to 20 for the total duration of motion indicated that for all instructions the closure figures contributed the greatest proportion of significant differences. Further inspection suggested that the effect of form tended to diminish as the rate of stimulation increased. It was concluded that the closure group was significantly different from the similar, proximal, and complete circle figures.

When measured by the mean duration of motion the effect of form on the perception of motion differed to some extent from the results obtained with the total duration of motion. Under instruction I, Rate 1 (Table 17) the effect of figural relationships was confined to observations involving the closure group. The effect of form appeared to diminish as the rate of stimulation increased. For Instructions II, III, and IV the similar figures were significantly different from all other figure combinations under Rate 1. In general, the effect of form on the perception of motion appeared to diminish as the rate of stimulation increased under all sets of instructions when measured by the mean duration of motion.

CHAPTER IV

DISCUSSION

The study was designed to determine the main effects and their interactions for changes in instruction, figural relationships, and rate of stimulation upon apparent motion.

Four sets of instructions were included in this study. Two sets involved changes in formal instructions to the subject; two sets involved changes in the attitude or mental set of the subjects. The inclusion of the latter pair was made possible by the statements of voluntary control, i. e., facilitating and/or inhibiting, of the perception of motion by eight of the twelve subjects in this study. Of the remaining four subjects, only two were certain that they could not control the perception of motion.

Two hypotheses concerning the fixed variable of instruction were formulated. The first hypothesis stated that changes in formal instructions may significantly affect the duration of apparent motion, the second hypothesis stated that attitude or mental set may not significantly affect the duration of motion. Each hypothesis was evaluated for both total and mean durations of motion for all categories considered in this study

When measured by the total duration of motion, instruction was a significant variable in the analyses of the perception of lighted figures in motion, the perception of apparent motion involving one lighted figures, and in three dimensional perceptions. Instruction was not a significant variable in the analyses involving all apparent motion perception, all shadow motion perception, perception of lighted figures in motion not designated as fusion, and the perception of two dimensional motion. When the individual sets of instructions were evaluated with the Wilcoxon tests for the perception of all lighted figures in motion, it was found that the major portion of the significant differences obtained involved comparisons with Instruction III, the mental set to facilitate motion. The instructions concerned with formal changes, i.e , Instructions I and II, were not found to be significantly different. The first hypothesis, that a change in formal instructions may significantly affect the duration of apparent motion, was not confirmed when measured by the total duration of motion.

Concerning the second hypothesis, the Wilcoxon tests indicated that Instruction III, the mental set to facilitate motion, was an effective variable The mental set to inhibit the perception of motion, Instruction IV, was not as effective variable. Only the trends indicated in the bar graphs representing the perception of lighted figures in motion were analyzed with the Wilcoxon test. Similar trends may be noted in the bar graphs for the perceptions of one lighted figure motion and three dimensional motion (Figs. 6 and 8) for the total duration of motion measurements.

When measured by the mean duration of motion, instruction was a significant variable in the analyses involving all apparent motion perception, the perception of lighted figures in motion, the perception of fused motion, and the perception of two dimensional motion.

it was not a significant variable in the analyses involving shadow motion perception, the perception of unfused motion, and in three dimensional motion perceptions. The first hypothesis, that a change in formal instructions may significantly effect the duration of motion, was evaluated with the Wilcoxon test, for the perception of all lighted figures in motion. Instruction I differed significantly from Instruction II. The first hypothesis was confirmed when measured by the mean duration of motion. The Wilcoxon test computations for the evaluation of the effect of instructions III and IV, for the perception of all lighted figures in motion, indicated that Instruction III was an effective variable, while Instruction IV was not an effective variable. The second hypothesis, that changes in attitude or mental set may not significantly affect the duration of motion, was only partially confirmed.

Formal instructions were a significant variable when measured by the mean duration of motion, but were not significant when measured by the total duration of motion. The mean duration measure apparently was more susceptible to the manipulation of the subjects. That is, extremely brief interruptions in the perception of apparent motion were less likely to be reported by the observer when he was asked to report the perception of one light in motion. The total duration of this motion was not as variable.

Changes in mental sets were significant variables when measured by both total and mean durations. The result was consistent in that Instruction III, the mental set to facilitate motion, was a significant variable in both instances. Mental set would appear to have a unidirectional effect on the perception of motion. Instruction IV, the mental set to inhibit the perception of motion, was not a significant variable. These results may be explained on another basis than a mental set or attitude. The same effect would be obtained if differences in the observers' willingness to be critical of the "goodness" of motion were postulated. The subjects, in general, appeared to be less critical of their perceptions under Instruction III than they were under instruction IV. This possibility receives some support when it is noted that all of the observers voluntarily conceded their inability to modify the duration of motion at the end of the experimental trials. It is suggested that the accepted importance of mental set or attitude in the perception of motion may be weighted too heavily as an intra-organic variable. Instruction was the only variable that demonstrated inconsistency in reaching significant levels. The effect of the separate sets of instructions tended to diminish as the rate of stimulation increased. It may be concluded that instructional changes are not necessarily major determinants of apparent motion. It appears possible to control the effect of instructional changes through the careful selection of the experimental variables.

For the fixed variable, figural relationships, it was hypothesized that the stimulus patterns, rather than the individual forms, may significantly affect the duration of motion. Figural relationship, designated as Form was a significant variable for both total and mean durations in twelve of the fourteen analyses. It was not a significant variable for either the total or the mean duration under category e, i.e., motion not designated as fused motion. The Wilcoxon Test was computed for the differences between stimulus pairs in the perception of all lighted figures in motion. The computations for the total duration of motion indicated that, in general, the closure group was significantly different from all other stimulus figures. This pattern of significant differences was found under all sets of instructions and, in general, for all rates of stimulation. The several bar graphs representing all motion perception, the perception of all lighted figure motion, and the perception of fused motion, indicated the maintenance of the above pattern. The stimulus figures in the closure group yielded significantly lower total durations of motion than the other groups of stimulus figures. This closure group yielded longer total durations of motion than the other groups for the perception of shadow motion. In terms of qualitative aspects, i.e., two and three dimensional motion, the closure figures yielded a greater proportion of three dimensional motion. The effect of figural relationships appeared to drop out as the rate of stimulation increased when measured by the total duration of motion. In general, the closure figures resulted in significantly lower total durations of motion. The similar, proximal, and complete circles were not significantly different as measured by the total duration of motion.

Somewhat different results were obtained when the measure was the mean duration of motion. The Wilcoxon Test for significant differences for the perception of lighted figures in motion indicated that under Instructions II, III, and IV the similar figures were significantly different from all other figures. For Instruction I, Rate I, the closure figures contributed the major portion of significant differences. The effect of form appeared to drop out as the rate of stimulation increased In general, the several bar graphs yielded the same trend of longer mean durations for the similar figures. It was noted that, typically, the proximal and closure figures resulted in three dimensional motion, two dimensional motion appeared characteristically in response to stimulation by the similar figures and the complete circles. The two and three dimensional aspects of apparent motion appeared to be due to the stimulus patterns rather than the variables of instruction and rate of stimulation. It was concluded that the stimulus patterns rather than the individual shapes of the figures were effective variables in the perception of apparent motion. The stimulus figures involved in this study were most consistently perceived as fused into one figure. The analyses of variance for lighted figures in motion, i.e., motion not designated as fused, indicated that subjects constituted the only significant main effect. No consistent trend was noted in the bar graph representations for the main variables, instruction, form, and rate of stimulation. It was concluded that there were greater differences between groups, for the total and mean duration of motion, than within groups.

In a previous study (12), in which black line figures in an illuminated field were the stimulus figures, it was found that the pair of identical figures, i.e., two complete circles, yielded the shortest mean duration of motion In this study the complete circles were significantly different from the similar figures, and yielded significantly lower mean durations of motion. These findings raised the problem of interpreting the differences between similar figures and complete figures. The lesser mean durations for the complete figures may be explained on the basis of contour discrepancies in the perception of motion. That is, the subject may tend to be more critical of mis-matchings in the superimposition of two complete circles, whereas, the merging of unclosed contours, as in the similar figures, may be accepted as part of the perceived motion.

The third fixed variable in this study was the rate of stimulation. It was hypothesized that the rate of stimulation would be the primary determinant of apparent motion, regardless of the instructional set or the stimulus figure involved in the perception of motion. This hypothesis was confirmed The rate of stimulation was a significant variable in all analyses except for the perception of motion not designated as fusion. As stated previously, the analyses of variance for unfused motion yielded no significant F ratios for the rate of stimulation, instruction, or form. The general pattern in the several bar graphs indicated a decrease in total and mean durations of motion with an increase in the rate of stimulation. This result was in accordance with previous studies (12, 13, 17). The fast rate of stimulation, Rate 3, appeared to reduce the effects of instruction as well as the effects of figural relationships.

The data further indicated that the perception of shadow motion was related to the rate of stimulation. Saucer (13) reported an increase in shadow motion perception with an increase in the rate of stimulation. This effect was found in this study; the longest total and mean durations of motion were obtained under Rate 3. It was found that there was an interaction between the fast rate and the closure figures. The stimulus patterns formed by the closure figures resulted in more frequent reports of shadow motion.

The randomized variable, subjects, was significant, for both total and mean durations, in all analyses.

The results indicated that the main variables investigated in this study were effective determinants of apparent motion. The measures obtained, total and mean durations of motion, appeared to yield somewhat different results. The rate of stimulation appeared to be of primary importance in the determination of motion for both the total and mean durations. As the rate of stimulation increased the total and mean durations decreased. As the rate of stimulation increased the effectiveness of instruction and figural relationships diminished. For the perception of shadow motion an increase in rate of stimulation resulted in an increase in the perception of apparent motion. Both the total and mean durations appeared to increase.

Form, in terms of figural relationships, was an effective variable in the determination of apparent motion. When measured by the total duration, the least amount of apparent motion was obtained with the closure figures. When measured by the mean duration, the similar figures yielded the greatest mean times. The effectiveness of form appeared to drop out as rate increased.

Changes in instruction yielded less well defined results. When measured by the total duration a change in formal instructions was not an effective variable. When measured by the mean duration, a change in formal instructions was an effective variable. For both total and mean durations a mental set to facilitate motion was an effective variable, i.e., Instruction III. The effect of mental set appeared to be unidirectional since a mental set to inhibit apparent motion was not effective. The effect of instruction to the subject tended to drop out as the rate increased. It was noted that the degree to which an observer was critical of his perception of motion could account for the results without postulating a mental set.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

An experimental investigation of several determinants of apparent motion was performed. The fixed variables, instruction, form, and rate of stimulation, together with the randomized variable of subjects, were evaluated with a four dimensional analysis of variance. The Wilcoxon Matched-Pairs Signed-Rank Test was computed for selected aspects of apparent motion. In addition, graphs were included in the analysis of data.

Twelve adult, male subjects observed two pairs of stimulus figures, under three rates of stimulation, for each of four sets of instructions. A ten minute dark adaptation period preceded the experimental trials for each presentation of the two pairs of stimulus figures. Time measurements included the total duration of apparent motion and the mean duration of apparent motion for each 300 second observation period.

The data were analyzed for various types of apparent motion in terms of total and mean durations of motion. The timed measurements were independently obtained with a Gerbrand constant speed recorder, an Elmer noise tape, and a stop watch.

The stimulus figures consisted of geometric forms engraved in opaque plastic. The presentation of stimulus figures, instructions, and rates of stimulation was systematically ordered for the subjects

All subjects, however, began with Instruction I which was assumed as a base line for the evaluation of instructional changes.

Conclusions

Instruction was found to be a conditionally effective variable. The effectiveness of changes in instruction appeared to depend on the types of data considered. Furthermore, the effectiveness of changes in instructions was reduced as the rate of stimulation increased.

Formal changes in instruction, i.e., experimenter oriented, were not effective when measured by the total duration of motion in the perception of all lighted figures in motion. Formal changes were effective when measured by the mean duration of motion in the perception of all lighted figures in motion. It was concluded that the mean duration of motion was modified by rapid fluctuations in the type of motion reported, as a result of greater observer manipulation.

Instructional changes involving mental set or attitude were conditionally effective. The influence of mental set appeared to be unidirectionally effective. Instruction III, the mental set to facilitate the perception of motion, was an effective variable for both the total and mean durations of motion. Instruction IV, the mental set to inhibit the perception of motion, was not an effective variable. It was suggested that the willingness of the subject to vary the degree to which he was critical of his observations would account for the differences obtained more readily than a unidirectional mental set concept.

Form, in terms of figural relationship, appeared to be an effective variable in the determination of apparent motion. The effectiveness of form tended to diminish, however, with an increase in rate. The variation in total and mean durations was found to be greater between groups than within groups of stimulus figures. The figural relationships, rather than the individual shape of the figures, was found to be the effective variable. In general, the similar figures yielded the longest total and mean durations of motion. The closure figures yielded the least total and mean durations of apparent motion. The proximal figures and the complete circles tended to yield total and mean durations between the above mentioned groups. The obtained differences between the similar figures and the complete circles were attributed to the presence of a closed contour. It was concluded that the observers tended to be more discriminative of unmatched, superimposed complete figures in apparent motion.

The rate of stimulation appeared to be the primary determinant of apparent motion. The total and mean durations of lighted figures in motion decreased as the rate of stimulation was increased. This pattern was obtained regardless of instructional changes and changes in stimulus figures. It was found that the perception of shadow motion, for both total and mean durations of motion, tended to increase as the rate of stimulation was increased.

Subject variation was significant in all analyses. Subject differences appeared when measured both by the mean duration of motion and by the total duration of motion. Statements of voluntary control of the duration of motion made prior to the experimental trials were withdrawn by all subjects at the conclusion of the experiment.

There appeared to be a significant interaction between instructional changes and the rate of stimulation when the facilitation effect and the flash rate of 2 exposures per light per second appeared together.

There appeared to be a significant interaction between form and rate of stimulation when the closure figures were presented at rates 1,25 and 2.

An additional conclusion was that the mean duration of motion was subject to observer manipulation to a greater extent than the total duration of motion.

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BIOGRAPHICAL ITEMS

Norman Reichenberg was born November 26, 1918, in New York City, New York. He received the degree of Bachelor of Arts from the University of Michigan in 1950.

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This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of the committee. It was submitted to the Dean of the College of Arts and Sciences and to the Graduate Council and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

June 3, 1957

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